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Original research article

"I would never have done it if it hadn't been digital": A qualitative study on expectations and experiences of a digital management program for hip and knee osteoarthritis

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ABSTRACT

Objectives

To investigate the expectations and experiences of a digital management program for hip and knee OA, including education and exercises as well as asynchronous chat with an assigned physical therapist for feedback, questions and support.

Setting

This study was conducted at a regional hospital in the southern part of Sweden.

Methods

Nineteen patients (10 women), median age 66 (q1-q3, 57-71) years, with confirmed hip or knee OA were interviewed after completing their first six weeks in the program, using a semi-structured interview guide. The interviews were transcribed verbatim and were qualitatively analyzed using systematic text condensation.

Results

Three categories emerged during the interviews:

1) *Management options for mitigating the consequences of OA*; 2) *Experiences of the design and exercises within the program* and 3) *Perceived effects of the digital program over time, and suggested improvements*. The participants had mostly positive experiences of the program. Particularly important for these experiences were no waiting list, the flexibility of taking part in the program with regards to location and time, and the possibility to have daily contact with a physical therapist. These aspects were also emphasized as advantages compared to traditional care.

Conclusions

Digital management of OA, including education and exercise, was experienced as a valid alternative to traditional treatment in enabling the implementation of OA guidelines in a wider community. Easy access, exercising at one´s own convenience, flexible options, daily follow-up and support by a physical therapist were mentioned as the most important features. In addition, the results will contribute to further development and improvement of digital OA management programs.

Strengths and limitations of this study

- Participants were purposefully selected, including both sexes, who differed in age, OA severity and physical function in order to have rich and varied data to being able to evaluate shared pattern across cases.
- The use of a systematic text condensation analysis method facilitated cross-case synthesis of text and meaning
- Conducting the interviews via telephone may have resulted in less depth of the interviews due to a loss of visual input

BACKGROUND

Due to a combination of decreasing healthcare resources, long waiting lists, and limited options to meet the demands of the modern individual who often has a busy schedule, the use of web-based or digital management options in healthcare, so-called e-health, has increased significantly during the last decade [1-3]. Accessibility and flexibility, social motives and an option for anonymity and confidentiality are common arguments for choosing e-health [4-10].

Several digital management programs that incorporate web-based cognitive behavioral therapy have been developed for different conditions, such as anxiety [1], psoriasis [2, 11], and eating disorders [3], with promising results. A recent review also suggests that it may be easier to seek care and to incorporate the training into daily life when it is accompanied by the flexibility and anonymity that online delivery provides, and that some people even rated their relationship with the online-therapist higher than their relationship with their ordinary therapist [6]. However, web-based or digital management for musculoskeletal disorders have thus far not been studied to any great extent [14].

Individuals with osteoarthritis (OA) constitute one group of patients for whom e-health may be highly beneficial [4, 14]. As concluded previously in various literature, the guidelines for OA treatment (education, exercise and weight management) are not always implemented and few individuals with OA receive adequate management [4, 15, 16]. Lack of healthcare resources, living in rural areas, and having a lower level of education are all factors that may reduce the likelihood of receiving appropriate information on management options for OA

[4, 16]. Web-based or digital interventions for OA have been suggested as a way to make the availability of guideline-based OA management accessible to a wider community [4, 14, 17] and a few studies have shown promising results of e-health interventions on pain and physical function in patients with hip or knee OA [14, 17-20].

Joint Academy [21], was developed in Sweden and is a digital version of the evidence-based face-to-face self-management program *Better Management of Patients with OsteoArthritis* (BOA) [15, 22]. The program comprises OA education (instructional videos on OA, physical activity and weight management), individualized neuromuscular exercises with increasing difficulty, and an option to chat asynchronously with an assigned physical therapist for feedback and questions. Studies have shown that completing the introduction phase of six weeks in this digital OA management program reduces pain and medication intake, increases physical function and walking ability, as well as reduces the willingness for surgery [18, 19, 23]. However, patient experience of digital management for OA has not yet been evaluated. This knowledge may help to further improve e-health as a management option for OA and to facilitate the implementation of OA guidelines in a wider community. Thus, the aim of this qualitative study was to investigate the expectations and experiences of a digital management program in patients with hip or knee OA.

METHOD

Setting and sampling

This study was conducted at a regional hospital in the southern part of Sweden. From a total sample of 462 individuals that had completed six weeks in the digital OA management program between 2015 and 2018, 73 invitations with written information about the study

were sent out by e-mail. The inclusion criterion was hip or knee OA, previously confirmed or diagnosed by an orthopedic surgeon involved in the program and the exclusion criteria were i) reporting other joints than hip or knee as the primary joint for OA symptoms, and ii) not understanding and/or speaking Swedish. The participants were purposefully selected in order to represent both sexes, different age groups, perceived pain and physical function [24]. Twenty-one participants accepted the invitation to participate in this study. Two were excluded as one did not speak Swedish and one did not return our phone calls. Ten women and nine men, median age 66 (q1-q3, 57-71) years were consecutively included in the study. Their primary OA joint location was either in the knee (48%) or hip (52%). All participants in this study completed the program via stationary computers, laptops or mobile phones. The Regional Ethical Review Board in Lund, Sweden (Dnr 2017/651; Dnr 2017/980) approved the study and all patients gave their written informed consent prior to participation.

Data collection

The interviews were conducted by two of the authors (JE & AC), either as face-to-face interviews, by Skype or by telephone, depending on the participant's location and access to Skype. The semi-structured interview guide included areas of interest such as 1) experiences of living with OA, 2) expectations of the management program before participating, 3) experiences of the digital management program, and 4) experiences of factors that may have increased their motivation, persistence and emotional reactions. In addition, the participants were asked to suggest possible improvements to the program. Follow-up questions were used to encourage the participants to elaborate on the subject and to explain or clarify the meaning and consequences of their experiences. The interview guide and follow-up questions were pilot tested and was then subjected to minor editing. The

interviews, which lasted approximately 30-40 minutes, were recorded and transcribed verbatim. The transcripts were analyzed using systematic text condensation (STC) according to Malterud [25], which is based on Giorgi´s phenomenological analysis [26]. STC was chosen as the procedure facilitates cross-case synthesis of text and meaning [25]. Data collection stopped when no further information was added. See Appendix 1 for interview guide.

Data analysis

First, the interview transcripts were read to get a general impression of the whole and to identify primary themes. Then, meaning units were identified and formulated into codes that represented the core of the statements. During this phase, three of the authors (JE, AC, and CSH) worked individually to identify as many perspectives and perceptions as possible in the material. Next, all authors worked together with the coded data to produce one set of data, extracting duplicates and data that were not relevant for the aim of the study. The coded data were then organized into subcategories, and the content of the meaning units of each category was re-examined. The meaning and representation of the data was formulated into aspects representing the content. Thereafter, the subcategories were organized into categories. To validate the categories and make sure that no important aspects had been overlooked, the clusters were referred back to the raw data, and read through once again by the authors. Finally, the re-contextualized data was expressed as interpretations of the meaning of each category and representative quotes were selected for each category/subcategory.

RESULT

Three categories were uncovered during the analysis:

1) Management options for mitigating the consequences of OA, with two sub-categories a) Consequences of OA on everyday life and b) Expectations when joining the digital program. 2) Experiences of the design and exercises within the program, with four sub-categories a) Easy to execute, b) Flexibility to choose when and where, c) The importance of interacting with healthcare professionals and d) Other motivating factors. 3) Perceived effects of the digital program over time, and suggested improvements, with three subcategories a) Perceived effects of the program after the initial six weeks, b) Reasons for continuing to participate in the program and c) Suggestions for improving the digital program.

Management options for mitigating the consequences of OA

This category entailed the experiences of the perceived consequences of OA and the desirous search for a cure that would reduce their symptoms. All participants experienced severe pain and decreased physical function prior to joining the digital program. They were eager to try any treatment hoping that the program could reduce their symptoms and improve their quality of life.

Consequences of OA on everyday life

The participants described symptoms such as pain, disrupted sleep, deteriorating ability to walk, being immobile, and activity limitations. Pain was the main motivation for seeking professional management. The participants also found that their decreased functioning was not only affecting themselves, but was also a burden on their partners and family. They were trying all sorts of ways to ease the pain and to regain motor function.

"I felt that it was impossible to continue in this way as I was in such intense pain…" (I18)

Expectations when joining the digital program

When joining the digital program, most participants expressed that they were expecting improvements in terms of reduced OA symptoms, such as reduced pain, and improved flexibility and function to better cope with their everyday life. Generally, they did not expect to be fully cured, but were anticipating to get better, or at least, not worse. However, a few participants expressed that they had none or little faith in the management program. They explained that they had signed up mostly out of curiosity to see if this program may help them, since all former management options had failed to reduce their symptoms.

"The expectations that I had were to be more flexible and to reduce the pain. That was how I figured it could be." (I18)

Experiences of the design and exercises within the program

In general, the participants' experiences of the program were positive. They found the program very easy to execute, flexible, and motivational. The interaction with the physical therapist was described as important for support and encouragement.

Easy to execute

Most participants were satisfied with the set-up of the program. The program was perceived as structured, educational, and very simple to execute. Other elements that facilitated participation were instructional videos, email reminders, and that the exercises were individually customized with increasing difficulty, but also quickly accomplished.

"This is such a great set-up. Not only the exercises, it's really educational and you learn what osteoarthritis is really about." (I13)

"I found it really easy to follow. It does not take long and it's really good to receive these reminders by email" (I18)

However, a few participants perceived some difficulties in understanding how the program worked. They found that the progression of the exercises was not clearly described or that it was difficult to understand specific words used in the videos.

"To me it was hard to follow in the beginning and it actually took some time before I understood it correctly. It took like a few weeks until I really got the system. And that was a pity I think." (I8)

Flexibility to choose when and where

All participants acknowledged the flexibility that was associated with this digital management program. The ability to execute the exercises at home, or at any place at any time, without any use of equipment was highly appreciated. The ability to control the time point for when to perform the exercises and not having to make a scheduled appointment at a specific location, were described as an advantage compared to traditional management, and were further expressed as time-saving and less stressful since participants did not have to take time off from work for OA management. One participant even expressed that she would never have completed such a program if it had not been digital.

"The flexibility, that I could decide on my own when to perform the exercises was really good. That I didn't have any scheduled time point when I had to dress, go out, and at this exact time point meet a physical therapist. That I could decide on my own…" (I11)

"I don't think this is bad at all, to have it on the internet like this. I would never have done it if it hadn't been digital" (I17)

Some participants described that there were long waiting lists for traditional OA management in primary care and that the digital program was, thus, a flexible alternative that they could start at once.

"Yes, it was also like, there was such a long waiting list for primary care. So I thought…this,…this I can start doing right away." (I10)

The importance of interacting with healthcare professionals

Receiving an OA diagnosis without any physical meeting was perceived as a bit awkward to some participants. Some concerns were revealed regarding the risk of missing serious diseases if the diagnosis was given by phone or internet.

"It's somewhat hard to give a diagnosis over the phone. You can do it, but it's more difficult and you can miss things… there could have been a tumor there…" (I14)

The majority of the participants had a very positive experience of the interaction with their online physical therapist. They described that they received fast responses to their questions, as well as information and encouragement, and that they often received feedback within a few hours. Some expressed that the engagement from their physical therapist was valuable for support and encouragement, especially if they experienced pain during the exercises. The daily contact with their physical therapist encouraged them to perform their exercises every day, which was also perceived as an advantage compared to traditional care management.

> *"I think it's excellent to have daily contact. I think it's outstanding. That puts pressure on me to really do these exercises and to answer him* [the physical therapist] *and to give him an opportunity to give feedback and information about other things… You can't go to a physical therapist every day, every day, every day. That won't work. They won't have time for me, they have others to take care of as well. "* (I12)

In contrast, some participants experienced the contact with their online physical therapist to be unsatisfactory or even non-existent. They described that it could take a week before they received any response, that the questions were only partly answered, or that they received no answer at all. Continuous follow-up with feedback and encouragement on their performance in the program was also lacking.

> *"In the beginning they said that someone would get in touch with me on a regular basis and things like that. But this hasn't happened as I expected"* (I9)

Other motivating factors

The daily email reminders were typically highlighted as a motivator since they ensured that participants did not forget about the exercises and pushed them to perform the activities every day. Improved OA symptoms, and the measurement feedback system provided by the program were other factors that were mentioned as contributing to the participants' motivation to perform the exercises.

> *"It was there, popped up in my email box every day. OK, today I'll do this exercise...it was something that pushed me. That was good I think…I needed that."* (I8)

Perceived effects of the digital program over time and suggested improvements

The majority of the participants reported improved functioning and reduced pain. However, some people felt no improvements and that their symptoms were the same as before entering the program. Many continued to participate in the program after the initial six weeks to maintain the positive improvements. Although the participants were positive to the digital program, they suggested a broader variation of exercises as well as follow-ups by video calls.

Perceived effects of the digital program after the initial six weeks

Several participants experienced significant reductions in OA symptoms after completing the program. Improvements commonly mentioned were reduced pain, increased flexibility, and improved walking abilities. In many cases the symptoms were still present but were

perceived to have improved significantly, leading to increased quality of life and less focus on the disease. Many described that they had recommended the program to friends and relatives suffering from hip or knee OA, since they were satisfied with the result and wished that more people could undergo the same management program.

> *"It has helped me fantastically. I don't think I could have walked the way I do today if I hadn't done this… I don't think so… I think this program has had an absolute crucial role in the fact that I can manage my everyday life as well as I can now, even though I have quite big problems."* (I2)

Not all participants perceived that they had reduced symptoms or improvements after six weeks in the program. Some described that their symptoms were still the same or had initially improved, and then worsened with deteriorating physical function and increased pain. However, several of these participants still believed in the set-up despite not experiencing the results they wished for. This lack of positive results was attributed to a belief that they entered the program too late, i.e., that the exercises might have helped if they had started at an earlier stage of the disease, or that the exercises may have slowed down the disease progression.

> *"The sad thing is that even if I do these exercises, every day, every week, every month, every year… nothing happens… I don't get any better."* (I4)

"It felt really good in the beginning. The reason that it didn't help me is probably because I started too late." (I12)

Reasons for continuing to participate in the program

Many continued to do their exercises after the six weeks evaluation. Perceived functional improvements and pain reduction as well as fear of the symptoms worsening were highly motivating factors for continuing to perform the exercises. Another reason was that it might help them to be well prepared for any upcoming surgery.

"I believe in these exercises. I believe that exercise is good for osteoarthritis. I am convinced. And I think… if I stop doing this… then this terrible pain will start again." (I8)

On the other hand, reduced pain and scheduled surgery were described by some participants as reasons for not continuing the program.

"The pain was generally reduced… and then I did not feel as motivated as before so I quit doing the exercises… yes I did. Generally, in physical therapy, it's hard to keep your motivation up if you don't have a lot of pain." (I19)

"I have met with my orthopedist and I'm scheduled for surgery… I feel that the end of this problem is near. That's why I'm not performing the exercises as I should anymore." (I18)

Suggestions for improving the digital program

The participants suggested a few possible improvements to the digital program. For example, many experienced that there were too few exercises with little variation, and the exercises were perceived as somewhat monotonous after a while, especially if the participants were highly active in the program, i.e., carried out exercises several days a week. It was suggested that varying and/or adding more exercises would increase motivation to perform them.

> *"In the end it became a bit boring since there were so few movements… so I added some extra on my own… It was a bit boring to do the same thing every day."* (I14)

> Some participants that were not satisfied with the communication with the online physical therapist suggested improved patient-physical therapist interaction using increased feedback and encouragement. Another suggestion included follow-ups video calls or Skype to enhance feedback on the individual performance of specific exercises

> *"You could send a video via internet and the physical therapist will then check that you have performed the exercise and performed it correctly and correct you if you have performed it incorrectly."* (I19)

DISCUSSION

We sought to investigate participant perspectives of a digital management program for hip and knee OA. The majority of the participants reported improvements after the initial six weeks, such as reduced pain, increased mobility, and a sense of improved quality of life. In general the participants found that the program was easy to execute. The flexibility of being able to perform the exercises anywhere and at any time point was highly appreciated. The daily contact with the physical therapist was considered very important and an advantage compared to traditional care and the participants felt that the support and encouragement they received was important to continue exercising.

Despite international guidelines [28], many patients with hip and knee OA do not receive appropriate treatment and information regarding OA management options [4, 15, 16]. Web-based or digital management programs have been proposed as an option for facilitating the implementation of non-surgical treatment as they have the potential to reach more individuals in need of OA treatment [4]. The participants in the current study were mostly positive to the set-up of the program. Being able to perform the exercises whenever and wherever they desired, without needing to take time off from work, was described as valuable. Several participants also mentioned that the digital program was something they could start doing right away instead of being put on a waiting list. They also experienced the program to be educational and they felt motivated by the daily email reminders and the feedback system that were provided by the program. This result is in line with previous studies investigating patient perceptions of digital OA management, e.g., through internet or tele rehabilitation, where the participants experienced such programs to be convenient and time-saving [29, 30].

Exercise is one of the cornerstones of OA management [28]. However, the outcome of the OA management program is highly dependent on adherence to the exercises, and people with OA seem to be among those with particularly poor adherence to this type of treatment [31]. A recent systematic review of people with hip and knee OA identified factors such as increased knowledge of the disease and benefits of exercise, reduced symptoms, easy access to training facilities, and the ability to fit the exercises into daily life as facilitating exercise participation, whereas long travel time and parking difficulties were considered as barriers [32]. The results from the current study indicate that a digital program may facilitate participation in OA management programs and eliminate some of the barriers associated with exercise participation, and further highlights the importance of adequate information and education regarding the benefits of exercise and different treatment options in OA. In addition, a digital delivery also enables the patients to continue their treatment week after week to further improvements and to sustain their achieved behavioral change.

Previous research indicates that support and encouragement from healthcare staff are important factors in facilitating exercise participation in people with hip and knee OA [32]. This was also reflected in the current study. Interaction with the physical therapist was another important aspect that was highlighted by the participants. Most participants had a positive experience of the contact with their assigned physical therapist and they were highly motivated by the daily contact and the support and encouragement that were provided. This result further emphasizes previous findings that a strong therapeutic alliance can be established without meeting in person [33-35]. However, some participants were not satisfied with the contact, which in turn lowered their motivation to perform the exercises.

This may indicates that support and encouragement from the physical therapist are prerequisites for a satisfactory experience of a digital OA management program.

In accordance with studies on tele rehabilitation, [29, 30], some concerns were expressed in our interviews about being diagnosed online. A few patients were afraid that they may have been suffering from a more serious disease, such as cancer, and that a differential diagnosis may be difficult via the internet. It is therefore important to respond to these worries accordingly, and provide the patients with information that explains that OA is primarily diagnosed by symptoms and signs without any use of radiography or laboratory equipment [36]. Also, some participants wished to have follow-ups via video call to eliminate the risk of performing the exercises incorrectly. This is consistent with previous studies reporting that non-supervised home-based exercises can give rise to concerns regarding the correct performance of the exercises [5, 30, 37]. Video calls may, thus, be one way to develop the program further and to optimize the experiences of digital programs without any physical meeting. However, the influence of video conversations need further study.

Many participants in this study reported improvements in symptoms and physical function, such as reduced pain and improved walking ability. Interestingly, reduced pain and being scheduled for surgery were two factors described as both facilitators and barriers to continuing in the program. Some participants continued to exercise because they experienced that the program had reduced their pain and they were afraid that the pain would come back if they stopped doing the exercises. In contrast, some felt that reduced pain was a reason to stop doing the exercises, as their motivation was lost when pain no longer was an issue. Likewise, some participants continued to exercise since they wanted to

be ready and “as fit as possible” for a total joint replacement (TJR), whereas others quit doing the exercises when they were scheduled for TJR as they believed the surgery would solve their problems anyway. Pre-surgery exercise is known to improve outcomes such as length of hospitalization, knee range of motion, and physical function after total knee replacements [38] and such information is, therefore, important to include in the educational material to facilitate recovery after any future TJRs in these patients.

One strength of this study is that the participants were purposefully selected, including both men and women who differed in age, OA severity, physical function, and OA location (hip or knee) from different parts of Sweden. However, since the participants were located all over Sweden, the interviews were mostly conducted by telephone or via Skype. This approach may have resulted in less depth of the interviews due to a loss of visual input. Also, two of the participants completed the program more than one year prior to the interviews, which may have influenced their recollection of the program and thereby also the experiences expressed during the interviews.

Throughout the data analysis reflexivity has been considered, i.e., we have been aware that the pre-understanding that the authors may have as clinicians and researchers could affect the data, if one is not fully aware of previous experiences [39]. All authors worked separately during the data processing and there were continuous discussions during the analysis aimed at eliminating possible influences of previous experiences, which helped us to stay neutral to the data. In addition, we have also presented a signature after each quotation to show the representation of our participants, and to add transparency and trustworthiness to our findings and interpretations of the data.

CONCLUSION

A digital management program for OA, including education and exercise as well as asynchronous chats with an assigned physical therapist for feedback, questions and engagement, may be an alternative to traditional treatment and further facilitate the implementation of OA guidelines in a wider community. The participants had mostly positive experiences of the program, the flexibility of the program with regards to location and time. Regular and frequent contact with a physical therapist was deemed particularly important for a positive experience of the program and was also emphasized as an advantage compared to traditional care. In addition, the result of this study will contribute to the further development and improvement of digital management for OA.

AUTHORS' CONTRIBUTION

Anna Cronström, PhD contributed to the design of the study, conducted part of the interviews, was responsible for the analysis and interpretation of the data, and was in charge of writing the manuscript. Leif E Dahlberg, PhD contributed to the conception and design of the study, contributed to the interpretation of the data, and provided feedback on drafts of this paper. Håkan Nero, PhD contributed to the conception and design of the study, contributed to the analysis and interpretation of the data, and provided feedback on drafts of this paper. Jennifer Ericson, BSc student contributed to the conception and design of the study, conducted part of the interviews, contributed to the analysis and interpretation of the data, and provided feedback on drafts of this paper. Catharina Sjödahl Hammarlund, PhD contributed to the conception and design of the study, contributed to the analysis and interpretation of the data, and provided feedback on drafts of this paper. All authors have read and approved the final manuscript.

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COMPETING INTEREST

HN is a physical therapist and part-time consultant at the specific OA management program, which was used in the present study and LED is the co-founder and Chief Medical Officer in the corporation behind the same program. No other relationships or activities exist that could appear to have influenced the submitted work.

DATA SHARING STATEMENT

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

PATIENT AND PUBLIC INVOLVEMENT STATEMENT

The Joint Academy treatment program for OA is based on the evidence-based BOA concept [15]. In addition to the interviews in the present study, the digital platform has previously been further developed and improved by analyzing questionnaires and opinions from patients recruited via the Swedish Rheumatism Association. These patients were able to test Joint Academy and were extensively interviewed about their opinions. All other aspects of this research were performed without patient involvement. Patients were not invited to comment on the study design and were not consulted to develop patient-relevant outcomes or interpret the results. Patients were not invited to contribute to the writing or editing of this document for readability or accuracy.

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Interview guide - Experiences of a digital management program for hip and knee osteoarthritis (translated from the Swedish version)

How long have you had symptoms from your hip/knee?

Could you describe your symptoms before joining the program?

- How did your symptoms affect you everyday life?

What were your reasons for joining the program?

What were your expectations before joining the program?

How did you experience the treatment?

- Set-up
- Exercises
- Availability
- Layout

How was your motivation for doing the activities?

How did you experience your contact with the physical therapist?

Do you experience that the treatment has altered your symptoms?

- In what way/direction?

Have you continued with the program/home exercises after the initial six weeks?

- What where your reasons/motivations for continue/not continue?

How do you think Joint Academy could have done a better job in assisting your treatment?

At the end of the interview asking the participant to raise any subject not yet covered

Throughout the interview the participants were asked to elaborate on the subject and to explain or clarify the meaning and consequences of their experiences

COREQ (COnsolidated criteria for REporting Qualitative research) Checklist

A checklist of items that should be included in reports of qualitative research. You must report the page number in your manuscript where you consider each of the items listed in this checklist. If you have not included this information, either revise your manuscript accordingly before submitting or note N/A.

Topic	Item No.	Guide Questions/Description	Reported on Page No.
Domain 1: Research team and reflexivity			NA
Personal characteristics			
Interviewer/facilitator	1	JE & AC	7 & 22
Credentials	2	JE:BSc student, AC: PhD	22
Occupation	3	JE:Physiotherapy student, AC: Researcher	22
Gender	4	JE & AC: Female	
Experience and training	5	Basic training	7
Relationship with participants			
Relationship established	6	No relationship	NA
Participant knowledge of the interviewer	7	All participants had oral and written information which included that the data collection was part of her Bachelor thesis and future scientific publications.	6-7
Interviewer characteristics	8	JE & AC showed interest and empathy and gave relevant follow-up questions to encourage the participants to elaborate on their narratives.	
Domain 2: Study design			
Theoretical framework			
Methodological orientation and Theory	9	Systematic text condensation as described by Malterud, which is based on Giorgis' psychological phenomenological analysis (ref 21,22)	8
Participant selection			
Sampling	10	The participants were purposefully selected .....different age groups, perceived pain and physical function They were consecutively included...	6-7
Method of approach	11	Seventy three invitations with written information about the study were sent out by e-mail. Twenty-one accepted the invitation.	6
Sample size	12	Nineteen participated...	7
Non-participation	13	Two were excluded. One did not speak Swedish, one could not be reached.	7
Setting			
Setting of data collection	14	Mostly in their homes using Skype or telephone, two personal interviews	7
Presence of non-participants	15	None else were present besides the participants and researchers.	NA
Description of sample	16	Ten women and nine men, median age 66 (q1-q3, 57-71) years, OA joint location was either in the knee (48%) or hip (52%).	7
Data collection			
Interview guide	17	The interview guide and follow-up questions were pilot tested and were then subjected to minor editing.	7
Repeat interviews	18	No repeat interviews were carried out	NA
Audio/visual recording	19	The interviews were recorded.	8
Field notes	20	Field notes was taken with regard to emotinal reactions and so on.	
Duration	21	The duration was approximately 30-40 minutes.	8
Data saturation	22	Data collection stopped when no further information was added.	8
Transcripts returned	23	The transcripts were not returned to participants for comment and/or	NA

Topic	Item No.	Guide Questions/Description	Reported on Page No.
		correction.	
Domain 3: analysis and findings			
Data analysis			
Number of data coders	24	Three authors coded the data (JE,AC,CSH)	8
Description of the coding tree	25	The coding tree was not provided.	NA
Derivation of themes	26	The themes derived from the data.	8
Software	27	No software was used to manage the data.	NA
Participant checking	28	The participants did not provide feedback on the findings.	NA
Reporting			
Quotations presented	29	Participant quotations was presented to illustrate the findings and each quotation was identified with a signature.	21
Data and findings consistent	30	The data was rich, varied and consistent. No triangulation was done.	21
Clarity of major themes	31	Major themes were clearly presented in the findings.	8-17
Clarity of minor themes	32	There is a description of diverse cases and discussion of minor themes.	18-21

Developed from: Tong A, Sainsbury P, Craig J. Consolidated criteria for reporting qualitative research (COREQ): a 32-item checklist for interviews and focus groups. *International Journal for Quality in Health Care*. 2007. Volume 19, Number 6: pp. 349 – 357

Once you have completed this checklist, please save a copy and upload it as part of your submission. DO NOT include this checklist as part of the main manuscript document. It must be uploaded as a separate file.

BMJ Open

I would never have done it if it hadn't been digital": A qualitative study on patients' experiences of a digital management program for hip and knee osteoarthritis in Sweden

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Original research article

"I would never have done it if it hadn't been digital": A qualitative study on patients' experiences of a digital management program for hip and knee osteoarthritis in Sweden

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Keywords: e-health; digital management; osteoarthritis

ABSTRACT

Objectives

To investigate the experiences of a digital management program for hip and knee osteoarthritis (OA), including education and exercises as well as asynchronous chat with an assigned physical therapist for feedback, questions and support.

Setting

This study was conducted at a regional hospital in the southern part of Sweden.

Methods

Nineteen patients (10 women), median age 66 (q1-q3, 57-71) years, with confirmed hip or knee OA were interviewed after completing their first six weeks in the program, using a semi-structured interview guide. The interviews were transcribed verbatim and were qualitatively analyzed using systematic text condensation.

Results

Three categories emerged during the interviews:

1) *Management options for mitigating the consequences of OA*; 2) *Experiences of the digital program* and 3) *Perceived effects of the digital program over time.* The participants had mostly positive experiences of the program. Particularly important for these experiences were no waiting list, the flexibility of taking part in the program with regards to location and time, and the possibility to have daily contact with a physical therapist. These aspects were also emphasized as advantages compared to traditional care.

Conclusions

Digital management of OA, including education and exercise, was experienced as a valid alternative to traditional treatment in enabling the implementation of OA guidelines in a

wider community. Easy access, exercising at one´s own convenience, flexible options, daily follow-up and support by a physical therapist were mentioned as the most important features. In addition, the results will contribute to further development and improvement of digital OA management programs.

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Strengths and limitations of this study

- Participants were purposefully selected, including both sexes, who differed in age, osteoarthritis severity and physical function in order to have rich and varied data, when synthesizing shared patterns across cases
- The use of a systematic text condensation analysis method facilitated cross-case synthesis of text and meaning
- Conducting the interviews via telephone may have resulted in less depth of the interviews due to a loss of visual input, but also allowed inclusion of participants. form a wide geographic area.

BACKGROUND

Due to a combination of decreasing healthcare resources, long waiting lists, and difficulty to meet the demands of the modern individual who often has a busy schedule, the use of web-based or digital management options in healthcare, has increased significantly during the last decade [1-3]. Accessibility and flexibility, social motives and an option for anonymity and confidentiality are common arguments for choosing digital options [4-10]. A recent review also suggests that it may be easier to seek care and to incorporate the training into daily life when it is accompanied by the flexibility and anonymity that online delivery provides, and that some people even rated their relationship with the online-therapist higher than their relationship with their ordinary therapist [6]. However, web-based or digital management for musculoskeletal disorders have thus far not been studied to any great extent [11].

Individuals with osteoarthritis (OA) constitute one group of patients for whom digital management may be highly beneficial [4, 11]. As concluded previously in various literature, the guidelines for OA treatment (education, exercise and weight management)[12] are not always implemented and few individuals with OA receive adequate management [4, 13, 14]. Lack of healthcare resources, living in rural areas, and having a lower level of education are all factors that may reduce the likelihood of receiving appropriate information on management options for OA [4, 14]. Web-based or digital interventions for OA have been suggested as a way to make the availability of guideline-based OA management accessible to a wider community [4, 11, 15]. Unlike in patients with inflammatory arthritis where digital management does not seem to increase physical activity or quality of life [16], a few studies

have shown promising results of digital interventions on physical activity [17], pain and physical function in patients with hip or knee OA [11, 15, 18-20].

Joint Academy [19, 21, 22], was developed in Sweden and is a digital version of the evidence-based face-to-face self-management program *Better Management of Patients with OsteoArthritis* (BOA) [13, 23]. The program, as thoroughly described previously [19], comprises OA education (instructional videos on OA, physical activity and weight management), individualized neuromuscular exercises with increasing difficulty aiming at improving lower extremity strength and neuromuscular control, and an option to chat asynchronously with an assigned physical therapist for feedback and questions. Studies have shown that completing the introduction phase of six weeks in this digital OA management program reduces pain and medication intake, increases physical function and walking ability, as well as reduces the willingness for surgery [18, 19, 24]. However, patient experience of digital management for OA has not yet been evaluated. This knowledge may help to further improve digital management options for OA and to facilitate the implementation of OA guidelines in a wider community. Thus, the aim of this qualitative study was to investigate the patients' experiences of using a digital management program for hip and knee OA.

METHOD

Patient and public involvement statement

The Joint Academy treatment program for OA is based on the evidence-based BOA concept [13]. In addition to the interviews in the present study, the digital platform has previously been further developed and improved by analyzing questionnaires and opinions from patients recruited via the Swedish Rheumatism Association. These patients were able to test

Joint Academy and were extensively interviewed about their opinions. All other aspects of this research were performed without patient involvement. Patients were not invited to comment on the study design and were not consulted to develop patient-relevant outcomes or interpret the results. Patients were not invited to contribute to the writing or editing of this document for readability or accuracy.

Setting and sampling

This study was conducted at a regional hospital in the southern part of Sweden. From a total sample of 462 individuals that had completed six weeks in the digital OA management program between 2015 and 2018, 73 invitations with written information about the study were sent out by e-mail by the first author (AC). The inclusion criterion was clinical hip or knee OA, previously confirmed or diagnosed according to the ACR criteria [25, 26] by an orthopedic surgeon involved in the program. The exclusion criteria were i) reporting other joints than hip or knee as the primary joint for OA symptoms, and ii) not understanding and/or speaking Swedish. The participants were purposefully selected in order to represent both sexes, different age groups, perceived pain and physical function [27]. Twenty-one participants accepted the invitation to participate in this study. Two were excluded as one did not speak Swedish and one did not return our phone calls. Ten women and nine men, median age 66 (q1-q3, 57-71) years were consecutively included in the study. Their primary OA joint location was either in the knee (48%) or hip (52%) (See Table 1 for participant characteristics). All participants in this study completed the program via stationary computers, laptops or mobile phones. The Regional Ethical Review Board in Lund, Sweden (Dnr 2017/651; Dnr 2017/980) approved the study and all patients gave their written informed consent prior to participation.

Data collection

The interviews were conducted by two of the authors (JE & AC), either as face-to-face interviews, by Skype or by telephone, depending on the participant's location and access to Skype. The semi-structured interview guide included areas of interest such as 1) experiences of living with OA, 2) prior experiences of OA management, 3) experiences of the digital management program (e.g., set-up, educational contents, feed-back, feed-forward, availability and design), and 4) experiences of factors that may have increased their motivation, persistence and emotional reactions. In addition, the participants were asked to suggest possible improvements to the program. Follow-up questions were used to encourage the participants to elaborate on the subject and to explain or clarify the meaning and consequences of their experiences. The interview guide and follow-up questions were pilot tested on three older individuals with OA, not included in the study and was then subjected to minor editing. The interviews, which lasted approximately 30-40 minutes, were recorded and transcribed verbatim. Data collection stopped when no further information was added. See Appendix 1 for interview guide.

Data analysis

The transcripts were analyzed using systematic text condensation (STC) according to Malterud [28], which is based on Giorgi´s phenomenological analysis [29]. The procedure of the analysis consists of the following steps: 1) creating an overall impression and identifying themes; 2) distinguishing and sorting meaning units to codes; 3) formulating the meaning of each code meaning and 4) synthesizing the condensed meaning into descriptions and concepts (See Appendix 2 for examples). STC was chosen as the procedure facilitates cross-case synthesis of text and meaning [28]. Consequently, in the first step, the interview

transcripts were read to get a general impression of the whole and to identify primary themes. Then, meaning units were identified and formulated into codes that represented the core of the statements. During this phase, three of the authors (JE, AC, and CSH) worked individually to identify as many perspectives and perceptions as possible in the material. Next, all authors worked together with the coded data to produce one set of data, extracting duplicates and data that were not relevant for the aim of the study. The coded data were then organized into subcategories, and the content of the meaning units of each category was re-examined. The meaning and representation of the data was formulated into aspects representing the content. Thereafter, the subcategories were organized into categories. To validate the categories and make sure that no important aspects had been overlooked, the clusters were referred back to the raw data, and read through once again by the authors. Finally, the re-contextualized data was expressed as interpretations of the meaning of each category and representative quotes were selected for each category/subcategory.

RESULT

Three main categories were uncovered during the analysis:

1) Management options for mitigating the consequences of OA,

2) Experiences of the digital program, with four sub-categories a) Easy to execute, b) Flexibility to choose when and where, c) The importance of interacting with healthcare professionals and d) Other motivating factors and 3) Perceived effects of the digital program over time, with two subcategories a) Perceived effects of the program after the initial six weeks and b) Reasons for continuing to participate in the program (Figure 1). Participants' suggestions for improving the digital program were also analyzed.

Management options for mitigating the consequences of OA

This category entailed the experiences of the perceived consequences of OA and their eager search for a cure that would reduce their symptoms. All participants described symptoms such as pain, disrupted sleep, deteriorating ability to walk, being immobile, and activity limitations. Pain was the main motivation for seeking professional management. The participants also found that their decreased functioning was not only affecting themselves, but was also a burden on their partners and family. They were trying all sorts of ways to ease the pain and to regain motor function. They were eager to try any treatment hoping that the program could reduce their symptoms and improve their quality of life.

"I felt that it was impossible to continue in this way as I was in such intense pain…" (I18)

"The expectations that I had were to be more flexible and to reduce the pain. That was how I figured it could be." (I18)

Experiences of the digital program

This category includes four sub-categories; a) Easy to execute, b) Flexibility to choose when and where, c) The importance of interacting with healthcare professionals and d) Other motivating factors. In general, the participants' experiences of the program were positive. They found the program very easy to execute, flexible, and motivational. The interaction with the physical therapist was described as important for support and encouragement.

Easy to execute

Most participants were satisfied with the set-up of the program. The program was perceived as structured, educational, and very simple to execute. Other elements that facilitated participation were instructional videos, email reminders, and that the exercises were individually customized with increasing difficulty, but also quickly accomplished.

> *"This is such a great set-up. Not only the exercises, it's really educational and you learn what osteoarthritis is really about."* (I13)

> *"I found it really easy to follow. It does not take long and it's really good to receive these reminders by email"* (I18)

However, a few participants perceived some difficulties in understanding how the program worked. They found that the progression of the exercises was not clearly described or that it was difficult to understand specific words used in the videos.

> *"To me it was hard to follow in the beginning and it actually took some time before I understood it correctly. It took like a few weeks until I really got the system. And that was a pity I think."* (I8)

Flexibility to choose when and where

All participants acknowledged the flexibility that was associated with this digital management program. The ability to execute the exercises at home, or at any place at any time, without any use of equipment was highly appreciated. The ability to control the time point for when to perform the exercises and not having to make a scheduled appointment at

a specific location, were described as an advantage compared to traditional management, and were further expressed as time-saving and less stressful since participants did not have to take time off from work for OA management. One participant even expressed that she would never have completed such a program if it had not been digital.

> *"The flexibility, that I could decide on my own when to perform the exercises was really good. That I didn't have any scheduled time point when I had to dress, go out, and at this exact time point meet a physical therapist. That I could decide on my own…"* (I11)

> *"I don't think this is bad at all, to have it on the internet like this. I would never have done it if it hadn't been digital"* (I17)

Some participants described that there were long waiting lists for traditional OA management in primary care and that the digital program was, thus, a flexible alternative that they could start at once.

> *"Yes, it was also like, there was such a long waiting list for primary care. So I thought…this…this I can start doing right away."* (I10)

The importance of interacting with healthcare professionals

Receiving an OA diagnosis without any physical meeting was perceived as a bit awkward to some participants. Some concerns were revealed regarding the risk of missing serious diseases if the diagnosis was given by phone or internet.

"It's somewhat hard to give a diagnosis over the phone. You can do it, but it's more difficult and you can miss things… there could have been a tumor there…" (I14)

The majority of the participants had a very positive experience of the interaction with their online physical therapist. They described that they received fast responses to their questions, as well as information and encouragement, and that they often received feedback within a few hours. Some expressed that the engagement from their physical therapist was valuable for support and encouragement, especially if they experienced pain during the exercises. The daily contact with their physical therapist encouraged them to perform their exercises every day, which was also perceived as an advantage compared to traditional care management.

"I think it's excellent to have daily contact. I think it's outstanding. That puts pressure on me to really do these exercises and to answer him [the physical therapist] *and to give him an opportunity to give feedback and information about other things… You can't go to a physical therapist every day, every day, every day. That won't work. They won't have time for me, they have others to take care of as well. "* (I12)

In contrast, some participants experienced the contact with their online physical therapist to be unsatisfactory or even non-existent. They described that it could take a week before they received any response, that the questions were only partly answered, or that they received

no answer at all. Continuous follow-up with feedback and encouragement on their performance in the program was also lacking.

> *"In the beginning they said that someone would get in touch with me on a regular basis and things like that. But this hasn't happened as I expected"* (I9)

Other motivating factors

The daily email reminders were typically highlighted as a motivator since they ensured that participants did not forget about the exercises and pushed them to perform the activities every day. Improved OA symptoms, and the measurement feedback system provided by the program were other factors that were mentioned as contributing to the participants' motivation to perform the exercises.

> *"It was there, popped up in my email box every day. OK, today I'll do this exercise...it was something that pushed me. That was good I think…I needed that."* (I8)

Perceived effects of the digital program over time

This category includes two sub-categories; a) Perceived effects of the program after the initial six weeks and b) Reasons for continuing to participate in the program. The majority of the participants reported improved functioning and reduced pain. However, some people felt no improvements and that their symptoms were the same as before entering the program. Many continued to participate in the program after the initial six weeks to maintain the positive improvements. Although the participants

were positive to the digital program, they suggested a broader variation of exercises as well as follow-ups by video calls.

Perceived effects of the digital program after the initial six weeks

Several participants experienced significant reductions in OA symptoms after completing the program. Improvements commonly mentioned were reduced pain, increased flexibility, and improved walking abilities. In many cases the symptoms were still present but were perceived to have improved significantly, leading to increased quality of life and less focus on the disease. Many described that they had recommended the program to friends and relatives suffering from hip or knee OA, since they were satisfied with the result and wished that more people could undergo the same management program.

> *"It has helped me fantastically. I don't think I could have walked the way I do today if I hadn't done this… I don't think so… I think this program has had an absolute crucial role in the fact that I can manage my everyday life as well as I can now, even though I have quite big problems."* (I2)

Not all participants perceived that they had reduced symptoms or improvements after six weeks in the program. Some described that their symptoms were still the same or had initially improved, and then worsened with deteriorating physical function and increased pain. However, several of these participants still believed in the set-up despite not experiencing the results they wished for. This lack of positive results was attributed to a belief that they entered the program too late, i.e., that the exercises might have helped if

they had started at an earlier stage of the disease, or that the exercises may have slowed down the disease progression.

> *"The sad thing is that even if I do these exercises, every day, every week, every month, every year… nothing happens… I don't get any better."* (I4)

> *"It felt really good in the beginning. The reason that it didn't help me is probably because I started too late."* (I12)

Reasons for continuing to participate in the program

Many continued to do their exercises after the six weeks evaluation. Perceived functional improvements and pain reduction as well as fear of the symptoms worsening were highly motivating factors for continuing to perform the exercises. Another reason was that it might help them to be well prepared for any upcoming surgery.

> *"I believe in these exercises. I believe that exercise is good for osteoarthritis. I am convinced. And I think… if I stop doing this… then this terrible pain will start again."* (I8)

On the other hand, reduced pain and scheduled surgery were described by some participants as reasons for not continuing the program.

"The pain was generally reduced… and then I did not feel as motivated as before so I quit doing the exercises… yes I did. Generally, in physical therapy, it's hard to keep your motivation up if you don't have a lot of pain." (I19)

"I have met with my orthopedist and I'm scheduled for surgery… I feel that the end of this problem is near. That's why I'm not performing the exercises as I should anymore." (I18)

Suggestions for improving the digital program

The participants suggested a few possible improvements to the digital program. For example, many experienced that there were too few exercises with little variation, and the exercises were perceived as somewhat monotonous after a while, especially if the participants were highly active in the program, i.e., carried out exercises several days a week. It was suggested that varying and/or adding more exercises would increase motivation to perform them.

"In the end it became a bit boring since there were so few movements… so I added some extra on my own… It was a bit boring to do the same thing every day." (I14)

Some participants that were not satisfied with the communication with the online physical therapist suggested improved patient-physical therapist interaction using increased feedback and encouragement. Another suggestion included follow-ups video calls or Skype to enhance feedback on the individual performance of specific exercises

"You could send a video via internet and the physical therapist will then check that you have performed the exercise and performed it correctly and correct you if you have performed it incorrectly." (I19)

DISCUSSION

We sought to investigate participant experiences of a digital management program for hip and knee OA. The majority of the participants reported improvements after the initial six weeks, such as reduced pain, increased mobility, and a sense of improved quality of life. In general the participants found that the program was easy to execute. The flexibility of being able to perform the exercises anywhere and at any time point was highly appreciated. The daily contact with the physical therapist was considered very important and an advantage compared to traditional care and the participants felt that the support and encouragement they received was important to continue exercising. In addition, the participants suggested more variation in the exercises and follow-up by video-calls.

Despite international guidelines [12], many patients with hip and knee OA do not receive appropriate treatment and information regarding OA management options [4, 13, 14]. Web-based or digital management programs have been proposed as an option for facilitating the implementation of non-surgical treatment as they have the potential to reach more individuals in need of OA treatment [4]. The participants in the current study were mostly positive to the set-up of the program. Being able to perform the exercises whenever and wherever they desired, without needing to take time off from work, was described as valuable. Several participants also mentioned that the digital program was something they

could start doing right away instead of being put on a waiting list. They also experienced the program to be educational and they felt motivated by the daily email reminders and the feedback system that were provided by the program. This result is in line with previous studies investigating patient perceptions of digital OA management, e.g., through internet or tele rehabilitation, where the participants experienced such programs to be convenient and time-saving [30, 31].

Exercise is one of the cornerstones of OA management [12]. However, the outcome of the OA management program is highly dependent on adherence to the exercises. People with OA is reported to be among those with particularly poor adherence to this type of treatment [32], although there seem to be good adherence to treatment delivered online in these patients [33]. A recent systematic review of people with hip and knee OA identified factors such as increased knowledge of the disease and benefits of exercise, reduced symptoms, easy access to training facilities, and the ability to fit the exercises into daily life as facilitating exercise participation, whereas long travel time and parking difficulties were considered as barriers [34]. The results from the current study indicate that a digital program may facilitate participation in OA management programs and eliminate some of the barriers associated with exercise participation, such as access and time constrains, and further highlights the importance of adequate information and education regarding the benefits of exercise and different treatment options in OA. In addition, a digital delivery also enables the patients to continue their treatment week after week to further improvements and to sustain their achieved behavioral change.

Previous research indicates that support and encouragement from healthcare staff are important factors in facilitating exercise participation in people with hip and knee OA [34]. This was also reflected in the current study. Interaction with the physical therapist was another important aspect that was highlighted by the participants. Most participants had a positive experience of the contact with their assigned physical therapist and they were highly motivated by the daily contact and the support and encouragement that were provided. This result further emphasizes previous findings that a strong therapeutic alliance can be established without meeting in person [35-37]. However, some participants were not satisfied with the contact, which in turn lowered their motivation to perform the exercises. This may indicates that support and encouragement from the physical therapist are prerequisites for a satisfactory experience of a digital OA management program.

In accordance with studies on tele rehabilitation, [30, 31], some concerns were expressed in our interviews about being diagnosed online. A few patients were afraid that they may have been suffering from a more serious disease, such as cancer, and that a differential diagnosis may be difficult via the internet. It is therefore important to respond to these worries accordingly, and provide the patients with information that explains that OA is primarily diagnosed by symptoms and signs without any use of radiography or laboratory equipment [38]. Also, some participants wished to have follow-ups via video call to eliminate the risk of performing the exercises incorrectly. This is consistent with previous studies reporting that non-supervised home-based exercises can give rise to concerns regarding the correct performance of the exercises [5, 31, 39]. Video calls may, thus, be one way to develop the program further and to optimize the experiences of digital programs without any physical meeting. However, the influence of video conversations needs further study.

The results confirmed the findings of previous studies, in that the participants reported that the most important results of the program were improvements such as reduced pain, increased flexibility, and improved walking abilities [18, 19], which brought a sense of improved quality of life and less focus on the disease. Interestingly, reduced pain and being scheduled for surgery were two factors described as both facilitators and barriers to continuing in the program. Some participants continued to exercise because they experienced that the program had reduced their pain and they were afraid that the pain would come back if they stopped doing the exercises. In contrast, some felt that reduced pain was a reason to stop doing the exercises, as their motivation was lost when pain no longer was an issue. Likewise, some participants continued to exercise since they wanted to be ready and as fit as possible for a total joint replacement (TJR), whereas others quit doing the exercises when they were scheduled for TJR as they believed the surgery would solve their problems anyway. Pre-surgery exercise is known to improve outcomes such as length of hospitalization, knee range of motion, and physical function after total knee replacements [40] and such information is, therefore, important to include in the educational material to facilitate recovery after any future TJRs in these patients.

One strength of this study is that the participants were purposefully selected, including both men and women who differed in age, OA severity, physical function, and OA location (hip or knee) from different parts of Sweden. However, since the participants were located all over Sweden, the interviews were mostly conducted by telephone or via Skype. This approach may have resulted in less depth of the interviews due to a loss of visual input. Also, two of the participants completed the program more than one year prior to the interviews, which

may have influenced their recollection of the program and thereby also the experiences expressed during the interviews. Another limitation may be that some demographic data of the participants, such as education level, previous experience of using digital applications and year of OA diagnosis were not recorded. This information may have increased the generalizability of the results.

Throughout the data analysis reflexivity has been considered, i.e., we have been aware that the pre-understanding that the authors may have as clinicians and researchers could affect the data, if one is not fully aware of previous experiences [41]. All authors worked separately during the data processing and there were continuous discussions during the analysis aimed at eliminating possible influences of previous experiences, which helped us to stay neutral to the data. In addition, we have also presented a signature after each quotation to show the representation of our participants, and to add transparency and trustworthiness to our findings and interpretations of the data.

CONCLUSION

A digital management program for OA, including education and exercise as well as asynchronous chats with an assigned physical therapist for feedback, questions and engagement, may be an alternative to traditional treatment and further facilitate the implementation of OA guidelines in a wider community. The participants had mostly positive experiences of the program, the flexibility of the program with regards to location and time. Regular and frequent contact with a physical therapist was deemed particularly important for a positive experience of the program and was also emphasized as an advantage compared to traditional care. In addition, the result of this study will contribute to the further development and improvement of digital management for OA.

AUTHORS' CONTRIBUTION

Anna Cronström, PhD contributed to the design of the study, conducted part of the interviews, was responsible for the analysis and interpretation of the data, and was in charge of writing the manuscript. Leif E Dahlberg, PhD contributed to the conception and design of the study, contributed to the interpretation of the data, and provided feedback on drafts of this paper. Håkan Nero, PhD contributed to the conception and design of the study, contributed to the analysis and interpretation of the data, and provided feedback on drafts of this paper. Jennifer Ericson, BSc student contributed to the conception and design of the study, conducted part of the interviews, contributed to the analysis and interpretation of the data, and provided feedback on drafts of this paper. Catharina Sjödahl Hammarlund, PhD contributed to the conception and design of the study, contributed to the analysis and interpretation of the data, and provided feedback on drafts of this paper. All authors have read and approved the final manuscript.

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COMPETING INTEREST

HN is a physical therapist and part-time consultant at Joint Academy and LED is the co-founder and Chief Medical Officer in the corporation behind the same program. No other relationships or activities exist that could appear to have influenced the submitted work.

DATA SHARING STATEMENT

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

EXCLUSIVE LICENSE STATEMENT

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Table 1. Characteristics of the participants

Characteristics	**n=19**
Age *mean (min-max)*	65 (45-80)
Sex	
Women n	10
Men n	9
Retired *n*	10
OA location	
Hip n	10
Knee n	9
Pain baseline *(min-max)*	6.1 (1-9)
Physical function baseline *(min-max)*	8.6 (1-14)
EQ5D-3L index baseline *(min-max)*	0.59 (0.29-0.76)
Activity in the program *mean % (min-max)*	80.7 (19-93)

OA=osteoarthritis, pain was assessed with the Numeric Rating Scale (NRS) from 0-10, where 0 indicate no pain with higher numbers indicating more severe pain, physical function was assessed using the 30-second Chair Stand Test reflecting the number of repetitions of sitting to standing from a chair during a period of 30 seconds. EQ5D-3L= EuroQol – 5 dimension descriptive system assessing health-related quality of life - a higher EQ-5D-3L index indicates better health-related quality of life. Activity level was defined as the proportion of completed videos, exercises and questionnaires offered in the program.

683 **Figure 1.** Overview of the categories and subcategories describing the participants' experiences of
684 the digital

685

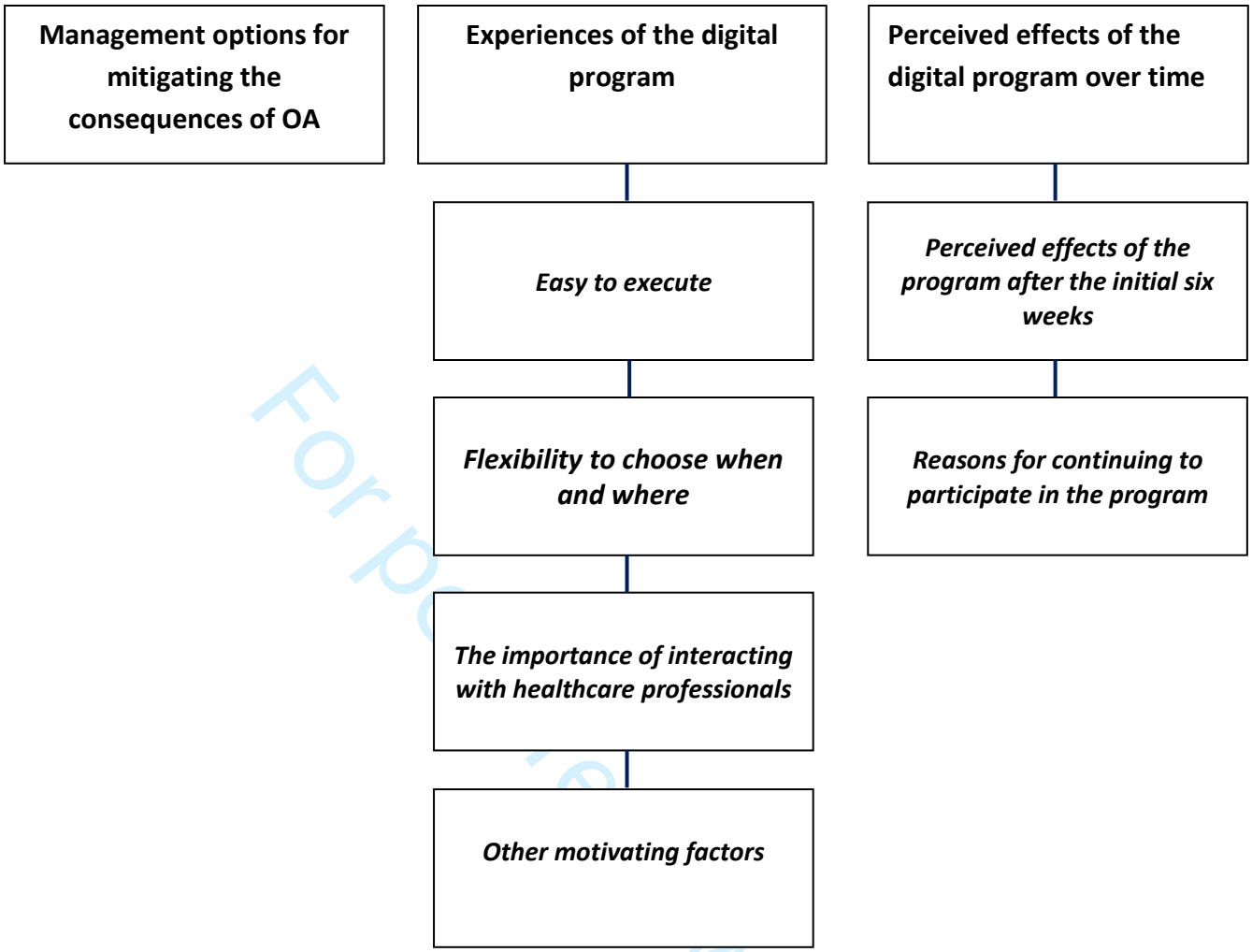

Figure 1. Overview of the categories and subcategories describing the participants' experiences of the digital management program for osteoarthritis

Appendix 1. Interview guide - Experiences of a digital management program for hip and knee osteoarthritis (translated from the Swedish version)

How long have you had symptoms from your hip/knee?

Could you describe your symptoms before joining the program?

- How did your symptoms affect you everyday life?

What were your reasons for joining the program?

What were your expectations before joining the program?

How did you experience the treatment?

- Set-up
- Exercises
- Availability
- Layout

How was your motivation for doing the activities?

How did you experience your contact with the physical therapist?

Do you experience that the treatment has altered your symptoms?

- In what way/direction?

Have you continued with the program/home exercises after the initial six weeks?

- What where your reasons/motivations for continue/not continue?

How do you think Joint Academy could have done a better job in assisting your treatment?

At the end of the interview asking the participant to raise any subject not yet covered

Throughout the interview the participants were asked to elaborate on the subject and to explain or clarify the meaning and consequences of their experiences

Appendix 2

Table 1. Examples of themes, meaning units, condensation of meaning units, codes and descriptions and concepts.

Interview and page	Themes	Meaning units	Condensed meaning unit	Code	Descriptions and concepts
2B3	Motivation	I wanted to continue because I know it's good for me. And I know deep inside that excercises will help me.	I know it will help me	Motivated by improvements	Other motivating factors
3c9	Flexibility	I had access 24/7. I could do it when it fitted me.	When it fitted me	Could do the exercises when it fitted the participant	Flexibility to choose when and where
10J4	Change in OA symptom	Yes, the pain was reduced and almost disappeared some days. I really improved so it was all positive	Reduced pain	The program reduced the OA symptoms	Perceived effects of the digital program over time

COREQ (COnsolidated criteria for REporting Qualitative research) Checklist

A checklist of items that should be included in reports of qualitative research. You must report the page number in your manuscript where you consider each of the items listed in this checklist. If you have not included this information, either revise your manuscript accordingly before submitting or note N/A.

Topic	Item No.	Guide Questions/Description	Reported on Page No.
Domain 1: Research team and reflexivity			NA
Personal characteristics			
Interviewer/facilitator	1	JE & AC	7 & 22
Credentials	2	JE:BSc student, AC: PhD	22
Occupation	3	JE:Physiotherapy student, AC: Researcher	22
Gender	4	JE & AC: Female	
Experience and training	5	Basic training	7
Relationship with participants			
Relationship established	6	No relationship	NA
Participant knowledge of the interviewer	7	All participants had oral and written information which included that the data collection was part of her Bachelor thesis and future scientific publications.	6-7
Interviewer characteristics	8	JE & AC showed interest and empathy and gave relevant follow-up questions to encourage the participants to elaborate on their narratives.	
Domain 2: Study design			
Theoretical framework			
Methodological orientation and Theory	9	Systematic text condensation as described by Malterud, which is based on Giorgis' psychological phenomenological analysis (ref 21,22)	8
Participant selection			
Sampling	10	The participants were purposefully selected .....different age groups, perceived pain and physical function They were consecutively included...	6-7
Method of approach	11	Seventy three invitations with written information about the study were sent out by e-mail. Twenty-one accepted the invitation.	6
Sample size	12	Nineteen participated...	7
Non-participation	13	Two were excluded. One did not speak Swedish, one could not be reached.	7
Setting			
Setting of data collection	14	Mostly in their homes using Skype or telephone, two personal interviews	7
Presence of non-participants	15	None else were present besides the participants and researchers.	NA
Description of sample	16	Ten women and nine men, median age 66 (q1-q3, 57-71) years, OA joint location was either in the knee (48%) or hip (52%).	7
Data collection			
Interview guide	17	The interview guide and follow-up questions were pilot tested and were then subjected to minor editing.	7
Repeat interviews	18	No repeat interviews were carried out	NA
Audio/visual recording	19	The interviews were recorded.	8
Field notes	20	Field notes was taken with regard to emotinal reactions and so on.	
Duration	21	The duration was approximately 30-40 minutes.	8
Data saturation	22	Data collection stopped when no further information was added.	8
Transcripts returned	23	The transcripts were not returned to participants for comment and/or	NA

Topic	Item No.	Guide Questions/Description	Reported on Page No.
		correction.	
Domain 3: analysis and findings			
Data analysis			
Number of data coders	24	Three authors coded the data (JE,AC,CSH)	8
Description of the coding tree	25	The coding tree was not provided.	NA
Derivation of themes	26	The themes derived from the data.	8
Software	27	No software was used to manage the data.	NA
Participant checking	28	The participants did not provide feedback on the findings.	NA
Reporting			
Quotations presented	29	Participant quotations was presented to illustrate the findings and each quotation was identified with a signature.	21
Data and findings consistent	30	The data was rich, varied and consistent. No triangulation was done.	21
Clarity of major themes	31	Major themes were clearly presented in the findings.	8-17
Clarity of minor themes	32	There is a description of diverse cases and discussion of minor themes.	18-21

Developed from: Tong A, Sainsbury P, Craig J. Consolidated criteria for reporting qualitative research (COREQ): a 32-item checklist for interviews and focus groups. *International Journal for Quality in Health Care*. 2007. Volume 19, Number 6: pp. 349 – 357

Once you have completed this checklist, please save a copy and upload it as part of your submission. DO NOT include this checklist as part of the main manuscript document. It must be uploaded as a separate file.

BMJ Open

I would never have done it if it hadn't been digital": A qualitative study on patients' experiences of a digital management program for hip and knee osteoarthritis in Sweden

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Original research article

"I would never have done it if it hadn't been digital": A qualitative study on patients' experiences of a digital management program for hip and knee osteoarthritis in Sweden

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Keywords: e-health; digital management; osteoarthritis

ABSTRACT

Objectives

To investigate the experiences of a digital management program for hip and knee osteoarthritis (OA), including education and exercises as well as an option to chat with an assigned physical therapist for feedback, questions and support.

Setting

This study was conducted at a regional hospital in the southern part of Sweden.

Methods

Nineteen patients (10 women), median age 66 (q1-q3, 57-71) years, with confirmed hip or knee OA were interviewed after completing their first six weeks in the program, using a semi-structured interview guide. The interviews were transcribed verbatim and were qualitatively analyzed using systematic text condensation.

Results

Three categories emerged during the interviews:

1) *Management options for mitigating the consequences of OA*; 2) *Experiences of the digital program* and 3) *Perceived effects of the digital program over time.* The participants had mostly positive experiences of the program. Particularly important for these experiences were no waiting list, the flexibility of taking part in the program with regards to location and time, and the possibility to have daily contact with a physical therapist. These aspects were also emphasized as advantages compared to traditional care.

Conclusions

Digital management of OA, including education and exercise, was experienced as a valid alternative to traditional treatment in enabling the implementation of OA guidelines in a wider community. Easy access, exercising at one´s own convenience, flexible options, daily follow-up and support by a physical therapist were mentioned as the most important features. In addition, the results will contribute to further development and improvement of digital OA management programs.

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Strengths and limitations of this study

- Participants were purposefully selected, including both sexes, who differed in age, osteoarthritis severity and physical function in order to have rich and varied data, when synthesizing shared patterns across cases
- The use of a systematic text condensation analysis method facilitated cross-case synthesis of text and meaning
- Conducting the interviews via telephone may have resulted in less depth of the interviews due to a loss of visual input, but also allowed inclusion of participants. form a wide geographic area.

BACKGROUND

Due to a combination of decreasing healthcare resources, long waiting lists, and difficulty to meet the demands of the modern individual who often has a busy schedule, the use of web-based or digital management options in healthcare, has increased significantly during the last decade [1-3]. Accessibility and flexibility, social motives and an option for anonymity and confidentiality are common arguments for choosing digital options [4-10]. A recent review also suggests that it may be easier to seek care and to incorporate the training into daily life when it is accompanied by the flexibility and anonymity that online delivery provides, and that some people even rated their relationship with the online-therapist higher than their relationship with their ordinary therapist [6]. However, web-based or digital management for musculoskeletal disorders have thus far not been studied to any great extent [11].

Individuals with osteoarthritis (OA) constitute one group of patients for whom digital management may be highly beneficial [4, 11]. As concluded previously in various literature, the guidelines for OA treatment (education, exercise and weight management)[12] are not always implemented and few individuals with OA receive adequate management [4, 13, 14]. Lack of healthcare resources, living in rural areas, and having a lower level of education are all factors that may reduce the likelihood of receiving appropriate information on management options for OA [4, 14]. Web-based or digital interventions for OA have been suggested as a way to make the availability of guideline-based OA management accessible to a wider community [4, 11, 15]. Unlike in patients with inflammatory arthritis where digital management does not seem to increase physical activity or quality of life [16], a few studies

have shown promising results of digital interventions on physical activity [17], pain and physical function in patients with hip or knee OA [11, 15, 18-20].

Joint Academy [19, 21, 22], was developed in Sweden and is a digital version of the evidence-based face-to-face self-management program *Better Management of Patients with OsteoArthritis* (BOA) [13, 23]. The program, as thoroughly described previously [19], comprises OA education (instructional videos on OA, physical activity and weight management), individualized neuromuscular exercises with increasing difficulty aiming at improving lower extremity strength and neuromuscular control, and an option to chat asynchronously with an assigned physical therapist for feedback and questions. Studies have shown that completing the introduction phase of six weeks in this digital OA management program reduces pain and medication intake, increases physical function and walking ability, as well as reduces the willingness for surgery [18, 19, 24]. However, patient experience of digital management for OA has not yet been evaluated. This knowledge may help to further improve digital management options for OA and to facilitate the implementation of OA guidelines in a wider community. Thus, the aim of this qualitative study was to investigate the patients' experiences of using a digital management program for hip and knee OA.

METHOD

Patient and public involvement statement

The Joint Academy treatment program for OA is based on the evidence-based BOA concept [13]. In addition to the interviews in the present study, the digital platform has previously been further developed and improved by analyzing questionnaires and opinions from

patients recruited via the Swedish Rheumatism Association. These patients were able to test Joint Academy and were extensively interviewed about their opinions. All other aspects of this research were performed without patient involvement. Patients were not invited to comment on the study design and were not consulted to develop patient-relevant outcomes or interpret the results. Patients were not invited to contribute to the writing or editing of this document for readability or accuracy.

Setting and sampling

This study was conducted at a regional hospital in the southern part of Sweden. From a total sample of 462 individuals that had completed six weeks in the digital OA management program between 2015 and 2018, 73 invitations with written information about the study were sent out by e-mail by the first author (AC). The inclusion criterion was clinical hip or knee OA, previously confirmed or diagnosed according to the ACR criteria [25, 26] by an orthopedic surgeon involved in the program. The exclusion criteria were i) reporting other joints than hip or knee as the primary joint for OA symptoms, and ii) not understanding and/or speaking Swedish. The participants were purposefully selected in order to represent both sexes, different age groups, perceived pain and physical function [27]. Twenty-one participants accepted the invitation to participate in this study. Two were excluded as one did not speak Swedish and one did not return our phone calls. Ten women and nine men, median age 66 (q1-q3, 57-71) years were consecutively included in the study. Their primary OA joint location was either in the knee (48%) or hip (52%) (See Table 1 for participant characteristics). All participants in this study completed the program via stationary computers, laptops or mobile phones. The Regional Ethical Review Board in Lund, Sweden

(Dnr 2017/651; Dnr 2017/980) approved the study and all patients gave their written informed consent prior to participation.

Data collection

The interviews were conducted by two of the authors (JE, physical therapy student & AC, physical therapist and PhD), either as face-to-face interviews, by Skype or by telephone, depending on the participant's location and access to Skype. The semi-structured interview guide included areas of interest such as 1) experiences of living with OA, 2) prior experiences of OA management, 3) experiences of the digital management program (e.g., set-up, educational contents, feed-back, feed-forward, availability and design), and 4) experiences of factors that may have increased their motivation, persistence and emotional reactions. In addition, the participants were asked to suggest possible improvements to the program. Follow-up questions were used to encourage the participants to elaborate on the subject and to explain or clarify the meaning and consequences of their experiences. The interview guide and follow-up questions were pilot tested on three older individuals with OA, not included in the study and was then subjected to minor editing. The two interviewers completed basic training in interview technique prior to data collection and had no relation to the participants in this study. The interviews, which lasted approximately 30-40 minutes, were recorded and transcribed verbatim. Data collection stopped when no further information was added, i.e., the interviews did not add any new information to the results. See Appendix 1 for interview guide.

Data analysis

The transcripts were analyzed using systematic text condensation (STC) according to Malterud [28], which is based on Giorgi´s phenomenological analysis [29]. The procedure of the analysis consists of the following steps: 1) creating an overall impression and identifying themes; 2) distinguishing and sorting meaning units to codes; 3) formulating the meaning of each code meaning and 4) synthesizing the condensed meaning into descriptions and concepts (See Appendix 2 for examples). STC was chosen as the procedure facilitates cross-case synthesis of text and meaning [28]. Consequently, in the first step, the interview transcripts were read to get a general impression of the whole and to identify primary themes. Then, meaning units were identified and formulated into codes that represented the core of the statements. During this phase, three of the authors (JE, AC, and CSH) worked individually to identify as many perspectives and perceptions as possible in the material. Next, all authors worked together with the coded data to produce one set of data, extracting duplicates and data that were not relevant for the aim of the study. The coded data were then organized into subcategories, and the content of the meaning units of each category was re-examined. The meaning and representation of the data was formulated into aspects representing the content. Thereafter, the subcategories were organized into categories. To validate the categories and make sure that no important aspects had been overlooked, the clusters were referred back to the raw data, and read through once again by the authors. Finally, the re-contextualized data was expressed as interpretations of the meaning of each category and representative quotes were selected for each category/subcategory.

RESULT

Three main categories were uncovered during the analysis:

1) Management options for mitigating the consequences of OA,

2) Experiences of the digital program, with four sub-categories a) Easy to execute, b) Flexibility to choose when and where, c) The importance of interacting with healthcare professionals and d) Other motivating factors and 3) Perceived effects of the digital program over time, with two subcategories a) Perceived effects of the program after the initial six weeks and b) Reasons for continuing to participate in the program (Figure 1). Participants' suggestions for improving the digital program were also analyzed.

Management options for mitigating the consequences of OA

This category entailed the experiences of the perceived consequences of OA leading to the patients´ eager search for a cure that would reduce their symptoms. All participants described symptoms such as pain, disrupted sleep, deteriorating ability to walk, being immobile, and activity limitations. Pain was the main motivation for seeking professional management. The participants also found that their decreased functioning was not only affecting themselves, but was also a burden on their partners and family. They were trying all sorts of ways to ease the pain and to regain motor function. They were eager to try any treatment hoping that the program could reduce their symptoms and improve their quality of life.

"I felt that it was impossible to continue in this way as I was in such intense pain…" (I18)

"…you know…I wasn't able to go downtown without thinking about how I would get back home again, when it was at its worst. I was also considering having surgery and other options, but only to get better. I was feeling really bad …" (I12)

"You take every chance for improvement that you get. In the end you know it'll be beneficial." (I3)

Experiences of the digital program

This category includes four sub-categories; a) Easy to execute, b) Flexibility to choose when and where, c) The importance of interacting with healthcare professionals and d) Other motivating factors. In general, the participants' experiences of the program were positive. They found the program very easy to execute, flexible, and motivational. The interaction with the physical therapist was described as important for support and encouragement.

Easy to execute

Most participants were satisfied with the set-up of the program. The program was perceived as structured, educational, and very simple to execute. Other elements that facilitated participation were instructional videos, email reminders, and that the exercises were individually customized with increasing difficulty, but also quickly accomplished.

"This is such a great set-up. Not only the exercises, it's really educational and you learn what osteoarthritis is really about." (I13)

"I found it really easy to follow. It does not take long and it's really good to receive these reminders by email" (I18)

However, a few participants perceived some difficulties in understanding how the program worked. They found that the progression of the exercises was not clearly described or that it was difficult to understand specific words used in the videos.

> *"To me it was hard to follow in the beginning and it actually took some time before I understood it correctly. It took like a few weeks until I really got the system. And that was a pity I think."* (I8)

Flexibility to choose when and where

All participants acknowledged the flexibility that was associated with this digital management program. The ability to execute the exercises at home, or at any place at any time, without any use of equipment was highly appreciated. The ability to control the time point for when to perform the exercises and not having to make a scheduled appointment at a specific location, were described as an advantage compared to traditional management, and were further expressed as time-saving and less stressful since participants did not have to take time off from work for OA management. One participant even expressed that she would never have completed such a program if it had not been digital.

> *"The flexibility, that I could decide on my own when to perform the exercises was really good. That I didn't have any scheduled time point when I had to dress, go out, and at this exact time point meet a physical therapist. That I could decide on my own…"* (I11)

"I don't think this is bad at all, to have it on the internet like this. I would never have done it if it hadn't been digital" (I17)

Some participants described that there were long waiting lists for traditional OA management in primary care and that the digital program was, thus, a flexible alternative that they could start at once.

"Yes, it was also like, there was such a long waiting list for primary care. So I thought…this…this I can start doing right away." (I10)

The importance of interacting with healthcare professionals

Receiving an OA diagnosis without any physical meeting was perceived as a bit awkward to some participants. Some concerns were revealed regarding the risk of missing serious diseases if the diagnosis was given by phone or internet.

"It's somewhat hard to give a diagnosis over the phone. You can do it, but it's more difficult and you can miss things… there could have been a tumor there…" (I14)

The majority of the participants had a very positive experience of the interaction with their online physical therapist. They described that they received fast responses to their questions, as well as information and encouragement, and that they often received feedback within a few hours. Some expressed that the engagement from their physical therapist was valuable for support and encouragement, especially if they experienced pain during the exercises. The daily contact with their physical therapist encouraged them to perform their

exercises every day, which was also perceived as an advantage compared to traditional care management.

> *"I think it's excellent to have daily contact. I think it's outstanding. That puts pressure on me to really do these exercises and to answer him* [the physical therapist] *and to give him an opportunity to give feedback and information about other things… You can't go to a physical therapist every day, every day, every day. That won't work. They won't have time for me, they have others to take care of as well. "* (I12)

In contrast, some participants experienced the contact with their online physical therapist to be unsatisfactory or even non-existent. They described that it could take a week before they received any response, that the questions were only partly answered, or that they received no answer at all. Continuous follow-up with feedback and encouragement on their performance in the program was also lacking.

> *"In the beginning they said that someone would get in touch with me on a regular basis and things like that. But this hasn't happened as I expected"* (I9)

Other motivating factors

The daily email reminders were typically highlighted as a motivator since they ensured that participants did not forget about the exercises and pushed them to perform the activities every day. Improved OA symptoms, and the measurement feedback system provided by the

program were other factors that were mentioned as contributing to the participants' motivation to perform the exercises.

> *"It was there, popped up in my email box every day. OK, today I'll do this exercise...it was something that pushed me. That was good I think…I needed that."* (I8)

Perceived effects of the digital program over time

This category includes two sub-categories; a) Perceived effects of the program after the initial six weeks and b) Reasons for continuing to participate in the program. The majority of the participants reported improved functioning and reduced pain. However, some people felt no improvements and that their symptoms were the same as before entering the program. Many continued to participate in the program after the initial six weeks to maintain the positive improvements. Although the participants were positive to the digital program, they suggested a broader variation of exercises as well as follow-ups by video calls.

Perceived effects of the digital program after the initial six weeks

Several participants experienced significant reductions in OA symptoms after completing the program. Improvements commonly mentioned were reduced pain, increased flexibility, and improved walking abilities. In many cases the symptoms were still present but were perceived to have improved significantly, leading to increased quality of life and less focus on the disease. Many described that they had recommended the program to friends and

relatives suffering from hip or knee OA, since they were satisfied with the result and wished that more people could undergo the same management program.

> *"It has helped me fantastically. I don't think I could have walked the way I do today if I hadn't done this… I don't think so… I think this program has had an absolute crucial role in the fact that I can manage my everyday life as well as I can now, even though I have quite big problems."* (I2)

Not all participants perceived that they had reduced symptoms or improvements after six weeks in the program. Some described that their symptoms were still the same or had initially improved, and then worsened with deteriorating physical function and increased pain. However, several of these participants still believed in the set-up despite not experiencing the results they wished for. This lack of positive results was attributed to a belief that they entered the program too late, i.e., that the exercises might have helped if they had started at an earlier stage of the disease, or that the exercises may have slowed down the disease progression.

> *"The sad thing is that even if I do these exercises, every day, every week, every month, every year… nothing happens… I don't get any better."* (I4)

> *"It felt really good in the beginning. The reason that it didn't help me is probably because I started too late."* (I12)

Reasons for continuing to participate in the program

Many continued to do their exercises after the six weeks evaluation. Perceived functional improvements and pain reduction as well as fear of the symptoms worsening were highly motivating factors for continuing to perform the exercises. Another reason was that it might help them to be well prepared for any upcoming surgery.

> *"I believe in these exercises. I believe that exercise is good for osteoarthritis. I am convinced. And I think… if I stop doing this… then this terrible pain will start again."* (I8)

On the other hand, reduced pain and scheduled surgery were described by some participants as reasons for not continuing the program.

> *"The pain was generally reduced… and then I did not feel as motivated as before so I quit doing the exercises… yes I did. Generally, in physical therapy, it's hard to keep your motivation up if you don't have a lot of pain."* (I19)

> *"I have met with my orthopedist and I'm scheduled for surgery… I feel that the end of this problem is near. That's why I'm not performing the exercises as I should anymore."* (I18)

Suggestions for improving the digital program

The participants suggested a few possible improvements to the digital program. For example, many experienced that there were too few exercises with little variation, and the exercises were perceived as somewhat monotonous after a while, especially if the participants were highly active in the program, i.e., carried out exercises several days a week. It was suggested that varying and/or adding more exercises would increase motivation to perform them.

> *"In the end it became a bit boring since there were so few movements… so I added some extra on my own… It was a bit boring to do the same thing every day."* (I14)

Some participants that were not satisfied with the communication with the online physical therapist suggested improved patient-physical therapist interaction using increased feedback and encouragement. Another suggestion included follow-ups video calls or Skype to enhance feedback on the individual performance of specific exercises

> *"You could send a video via internet and the physical therapist will then check that you have performed the exercise and performed it correctly and correct you if you have performed it incorrectly."* (I19)

DISCUSSION

We sought to investigate participant experiences of a digital management program for hip and knee OA. The majority of the participants reported improvements after the initial six weeks, such as reduced pain, increased mobility, and a sense of improved quality of life. In general the participants found that the program was easy to execute. The flexibility of being able to perform the exercises anywhere and at any time point was highly appreciated. The daily contact with the physical therapist was considered very important and an advantage compared to traditional care and the participants felt that the support and encouragement they received was important to continue exercising. In addition, the participants suggested more variation in the exercises and follow-up by video-calls.

Despite international guidelines [12], many patients with hip and knee OA do not receive appropriate treatment and information regarding OA management options [4, 13, 14]. Web-based or digital management programs have been proposed as an option for facilitating the implementation of non-surgical treatment as they have the potential to reach more individuals in need of OA treatment [4]. The participants in the current study were mostly positive to the set-up of the program. Being able to perform the exercises whenever and wherever they desired, without needing to take time off from work, was described as valuable. Several participants also mentioned that the digital program was something they could start doing right away instead of being put on a waiting list. They also experienced the program to be educational and they felt motivated by the daily email reminders and the feedback system that were provided by the program. This result is in line with previous studies investigating patient perceptions of digital OA management, e.g., through internet or tele rehabilitation, where the participants experienced such programs to be convenient and time-saving [30, 31].

Exercise is one of the cornerstones of OA management [12]. However, the outcome of the OA management program is highly dependent on adherence to the exercises. People with OA is reported to be among those with particularly poor adherence to this type of treatment [32], although there seem to be good adherence to treatment delivered online in these patients [33]. A recent systematic review of people with hip and knee OA identified factors such as increased knowledge of the disease and benefits of exercise, reduced symptoms, easy access to training facilities, and the ability to fit the exercises into daily life as facilitating exercise participation, whereas long travel time and parking difficulties were considered as barriers [34]. The results from the current study indicate that a digital program may facilitate participation in OA management programs and eliminate some of the barriers associated with exercise participation, such as access and time constrains, and further highlights the importance of adequate information and education regarding the benefits of exercise and different treatment options in OA. There were, however, some contrasting experiences of the digital program, mostly related to perceived symptom improvement and contact with the physical therapist. Future quantitative investigations may reveal if such differences are related to adherence, i.e., activity level in the program. Previous research conclude that including behavioral change techniques may increase adherence to exercise [35] and a digital delivery may enable the patients to continue their treatment week after week to further improvements and to sustain their achieved behavioral change.

Previous research indicates that support and encouragement from healthcare staff are important factors in facilitating exercise participation in people with hip and knee OA [34]. This was also reflected in the current study. Interaction with the physical therapist was

another important aspect that was highlighted by the participants. Most participants had a positive experience of the contact with their assigned physical therapist and they were highly motivated by the daily contact and the support and encouragement that were provided. This result further emphasizes previous findings that a strong therapeutic alliance can be established without meeting in person [36-38]. However, some participants were not satisfied with the contact, which in turn lowered their motivation to perform the exercises. This may indicate that support and encouragement from the physical therapist are prerequisites for a satisfactory experience of a digital OA management program.

In accordance with studies on tele rehabilitation, [30, 31], some concerns were expressed in our interviews about being diagnosed online. A few patients were afraid that they may have been suffering from a more serious disease, such as cancer, and that a differential diagnosis may be difficult via the internet. It is therefore important to respond to these worries accordingly, and provide the patients with information that explains that OA is primarily diagnosed by symptoms and signs without any use of radiography or laboratory equipment [39]. Also, some participants wished to have follow-ups via video call to eliminate the risk of performing the exercises incorrectly. This is consistent with previous studies reporting that non-supervised home-based exercises can give rise to concerns regarding the correct performance of the exercises [5, 31, 40]. Video calls may, thus, be one way to develop the program further and to optimize the experiences of digital programs without any physical meeting. However, the influence of video conversations needs further study.

The results confirmed the findings of previous studies, in that the participants reported that the most important results of the program were improvements such as reduced pain,

increased flexibility, and improved walking abilities [18, 19], which brought a sense of improved quality of life and less focus on the disease. Interestingly, reduced pain and being scheduled for surgery were two factors described as both facilitators and barriers to continuing in the program. Some participants continued to exercise because they experienced that the program had reduced their pain and they were afraid that the pain would come back if they stopped doing the exercises. In contrast, some felt that reduced pain was a reason to stop doing the exercises, as their motivation was lost when pain no longer was an issue. Likewise, some participants continued to exercise since they wanted to be ready and as fit as possible for a total joint replacement (TJR), whereas others quit doing the exercises when they were scheduled for TJR as they believed the surgery would solve their problems anyway. Pre-surgery exercise is known to improve outcomes such as length of hospitalization, knee range of motion, and physical function after total knee replacements [41] and such information is, therefore, important to include in the educational material to facilitate recovery after any future TJRs in these patients.

One strength of this study is that the participants were purposefully selected, including both men and women who differed in age, OA severity, physical function, and OA location (hip or knee) from different parts of Sweden. However, since the participants were located all over Sweden, the interviews were mostly conducted by telephone or via Skype. This approach may have resulted in less depth of the interviews due to a loss of visual input. Also, two of the participants completed the program more than one year prior to the interviews, which may have influenced their recollection of the program and thereby also the experiences expressed during the interviews. Another limitation may be that some demographic data of the participants, such as education level, previous experience of using digital applications

and year of OA diagnosis were not recorded. This information may have increased the generalizability of the results.

Throughout the data analysis reflexivity has been considered, i.e., we have been aware that the pre-understanding that the authors may have as clinicians and researchers could affect the data, if one is not fully aware of previous experiences [42]. All authors worked separately during the data processing and there were continuous discussions during the analysis aimed at eliminating possible influences of previous experiences, which helped us to stay neutral to the data. In addition, we have also presented a signature after each quotation to show the representation of our participants, and to add transparency and trustworthiness to our findings and interpretations of the data.

CONCLUSION

A digital management program for OA, including education and exercise as well as an option to chat with an assigned physical therapist for feedback, questions and engagement, may be an alternative to traditional treatment and further facilitate the implementation of OA guidelines in a wider community. The participants had mostly positive experiences of the program, the flexibility of the program with regards to location and time. Regular and frequent contact with a physical therapist was deemed particularly important for a positive experience of the program and was also emphasized as an advantage compared to traditional care. In addition, the result of this study will contribute to the further development and improvement of digital management for OA.

AUTHORS' CONTRIBUTION

Anna Cronström, PhD contributed to the design of the study, conducted part of the interviews, was responsible for the analysis and interpretation of the data, and was in charge of writing the manuscript. Leif E Dahlberg, PhD contributed to the conception and design of the study, contributed to the interpretation of the data, and provided feedback on drafts of this paper. Håkan Nero, PhD contributed to the conception and design of the study, contributed to the analysis and interpretation of the data, and provided feedback on drafts of this paper. Jennifer Ericson, BSc student contributed to the conception and design of the study, conducted part of the interviews, contributed to the analysis and interpretation of the data, and provided feedback on drafts of this paper. Catharina Sjödahl Hammarlund, PhD contributed to the conception and design of the study, contributed to the analysis and interpretation of the data, and provided feedback on drafts of this paper. All authors have read and approved the final manuscript.

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COMPETING INTEREST

HN is a physical therapist and part-time consultant at Joint Academy and LED is the co-founder and Chief Medical Officer in the corporation behind the same program. No other relationships or activities exist that could appear to have influenced the submitted work.

DATA SHARING STATEMENT

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

EXCLUSIVE LICENSE STATEMENT

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Table 1. Characteristics of the participants

Characteristics	**n=19**
Age *mean (min-max)*	65 (45-80)
Sex	
Women n	10
Men n	9
Retired *n*	10
OA location	
Hip n	10
Knee n	9
Pain baseline *(min-max*)	6.1 (1-9)
Physical function baseline *(min-max)*	8.6 (1-14)
EQ5D-3L index baseline *(min-max)*	0.59 (0.29-0.76)
Activity in the program *mean % (min-max)*	80.7 (19-93)

OA=osteoarthritis, pain was assessed with the Numeric Rating Scale (NRS) from 0-10, where 0 indicate no pain with higher numbers indicating more severe pain, physical function was assessed using the 30-second Chair Stand Test reflecting the number of repetitions of sitting to standing from a chair during a period of 30 seconds. EQ5D-3L= EuroQol – 5 dimension descriptive system assessing health-related quality of life - a higher EQ-5D-3L index indicates better health-related quality of life. Activity level was defined as the proportion of completed videos, exercises and questionnaires offered in the program.

Figure 1. Overview of the categories and subcategories describing the participants' experiences of the digital

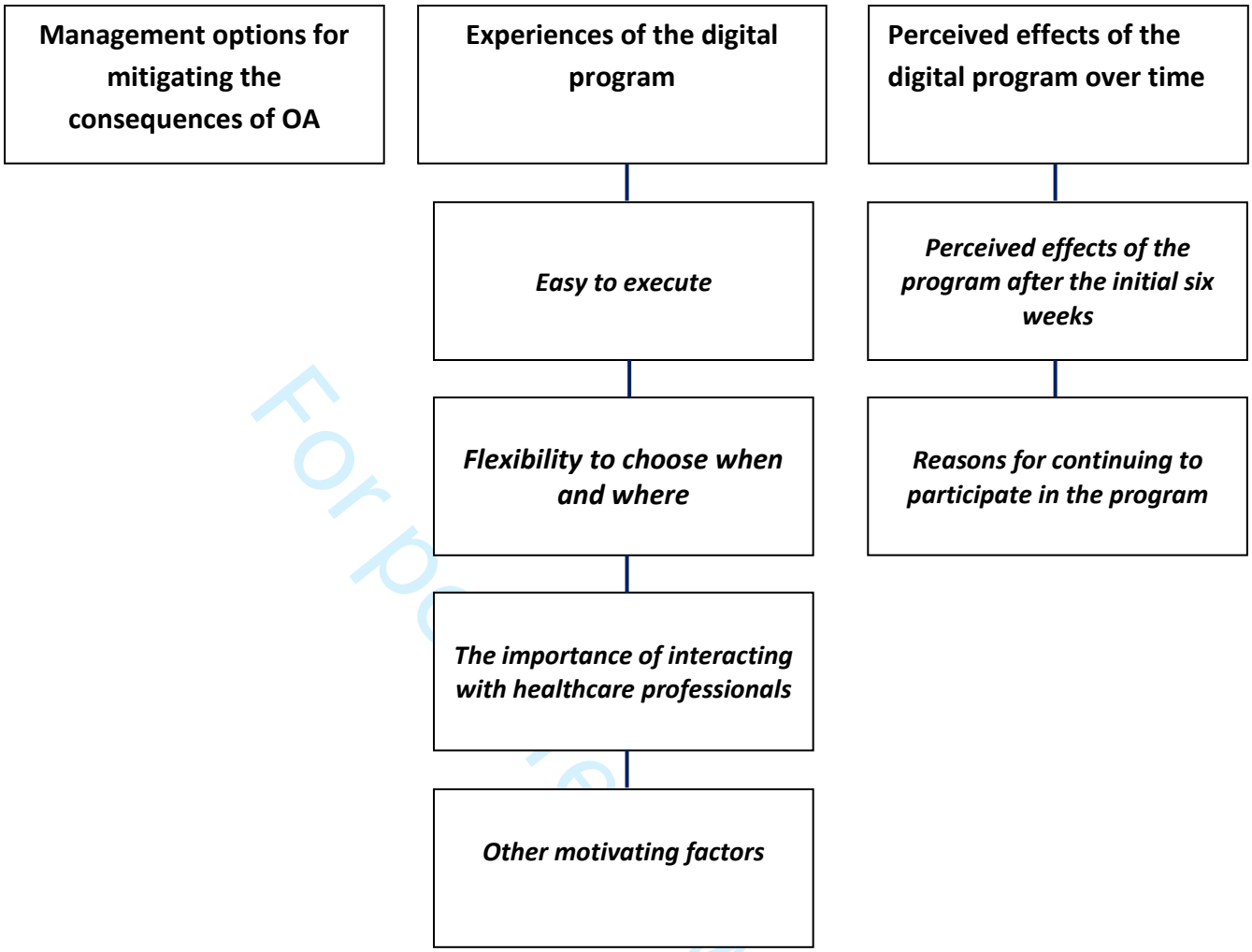

Figure 1. Overview of the categories and subcategories describing the participants' experiences of the digital management program for osteoarthritis

Appendix 1. Interview guide - Experiences of a digital management program for hip and knee osteoarthritis (translated from the Swedish version)

How long have you had symptoms from your hip/knee?

Could you describe your symptoms before joining the program?

- How did your symptoms affect you everyday life?

What were your reasons for joining the program?

What were your expectations before joining the program?

How did you experience the treatment?

- Set-up
- Exercises
- Availability
- Layout

How was your motivation for doing the activities?

How did you experience your contact with the physical therapist?

Do you experience that the treatment has altered your symptoms?

- In what way/direction?

Have you continued with the program/home exercises after the initial six weeks?

- What where your reasons/motivations for continue/not continue?

How do you think Joint Academy could have done a better job in assisting your treatment?

At the end of the interview asking the participant to raise any subject not yet covered

Throughout the interview the participants were asked to elaborate on the subject and to explain or clarify the meaning and consequences of their experiences

Appendix 2

Table 1. Examples of themes, meaning units, condensation of meaning units, codes and descriptions and concepts.

Interview and page	Themes	Meaning units	Condensed meaning unit	Code	Descriptions and concepts
2B3	Motivation	I wanted to continue because I know it's good for me. And I know deep inside that excercises will help me.	I know it will help me	Motivated by improvements	Other motivating factors
3c9	Flexibility	I had access 24/7. I could do it when it fitted me.	When it fitted me	Could do the exercises when it fitted the participant	Flexibility to choose when and where
10J4	Change in OA symptom	Yes, the pain was reduced and almost disappeared some days. I really improved so it was all positive	Reduced pain	The program reduced the OA symptoms	Perceived effects of the digital program over time

COREQ (COnsolidated criteria for REporting Qualitative research) Checklist

A checklist of items that should be included in reports of qualitative research. You must report the page number in your manuscript where you consider each of the items listed in this checklist. If you have not included this information, either revise your manuscript accordingly before submitting or note N/A.

Topic	Item No.	Guide Questions/Description	Reported on Page No.
Domain 1: Research team and reflexivity			NA
Personal characteristics			
Interviewer/facilitator	1	JE & AC	7 & 22
Credentials	2	JE:BSc student, AC: PhD	22
Occupation	3	JE:Physiotherapy student, AC: Researcher	22
Gender	4	JE & AC: Female	
Experience and training	5	Basic training	7
Relationship with participants			
Relationship established	6	No relationship	NA
Participant knowledge of the interviewer	7	All participants had oral and written information which included that the data collection was part of her Bachelor thesis and future scientific publications.	6-7
Interviewer characteristics	8	JE & AC showed interest and empathy and gave relevant follow-up questions to encourage the participants to elaborate on their narratives.	
Domain 2: Study design			
Theoretical framework			
Methodological orientation and Theory	9	Systematic text condensation as described by Malterud, which is based on Giorgis' psychological phenomenological analysis (ref 21,22)	8
Participant selection			
Sampling	10	The participants were purposefully selected .....different age groups, perceived pain and physical function They were consecutively included...	6-7
Method of approach	11	Seventy three invitations with written information about the study were sent out by e-mail. Twenty-one accepted the invitation.	6
Sample size	12	Nineteen participated...	7
Non-participation	13	Two were excluded. One did not speak Swedish, one could not be reached.	7
Setting			
Setting of data collection	14	Mostly in their homes using Skype or telephone, two personal interviews	7
Presence of non-participants	15	None else were present besides the participants and researchers.	NA
Description of sample	16	Ten women and nine men, median age 66 (q1-q3, 57-71) years, OA joint location was either in the knee (48%) or hip (52%).	7
Data collection			
Interview guide	17	The interview guide and follow-up questions were pilot tested and were then subjected to minor editing.	7
Repeat interviews	18	No repeat interviews were carried out	NA
Audio/visual recording	19	The interviews were recorded.	8
Field notes	20	Field notes was taken with regard to emotinal reactions and so on.	
Duration	21	The duration was approximately 30-40 minutes.	8
Data saturation	22	Data collection stopped when no further information was added.	8
Transcripts returned	23	The transcripts were not returned to participants for comment and/or	NA

Topic	Item No.	Guide Questions/Description	Reported on Page No.
		correction.	
Domain 3: analysis and findings			
Data analysis			
Number of data coders	24	Three authors coded the data (JE,AC,CSH)	8
Description of the coding tree	25	The coding tree was not provided.	NA
Derivation of themes	26	The themes derived from the data.	8
Software	27	No software was used to manage the data.	NA
Participant checking	28	The participants did not provide feedback on the findings.	NA
Reporting			
Quotations presented	29	Participant quotations was presented to illustrate the findings and each quotation was identified with a signature.	21
Data and findings consistent	30	The data was rich, varied and consistent. No triangulation was done.	21
Clarity of major themes	31	Major themes were clearly presented in the findings.	8-17
Clarity of minor themes	32	There is a description of diverse cases and discussion of minor themes.	18-21

Developed from: Tong A, Sainsbury P, Craig J. Consolidated criteria for reporting qualitative research (COREQ): a 32-item checklist for interviews and focus groups. *International Journal for Quality in Health Care*. 2007. Volume 19, Number 6: pp. 349 – 357

Once you have completed this checklist, please save a copy and upload it as part of your submission. DO NOT include this checklist as part of the main manuscript document. It must be uploaded as a separate file.